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Rev. R. MAIN, Vice-President, in the Chair.

Arthur Cayley, Esq. F.R.S., 2 Stone Buildings, Lincoln's Inn;
Rev. W. H. Drew, Blackheath, Proprietary School; and
J. J. Sylvester, Esq., 26 Lincoln's Inn Fields,

were balloted for and duly elected Fellows of the Society.

Note on the Eclipses of Agathocles, Larissa, and Thales. By the Astronomer Royal.

The Astronomer Royal has been enabled, by the kindness of Professor Hansen, to make an important addition to his investigations on the eclipses of Agathocles, Larissa, and Thales. Professor Hansen having computed, from the same tables which were adopted as fundamental in the preceding inquiry, the path of the shadow in the eclipse at Stiklastad, the Astronomer Royal has combined it with the eclipse at Larissa, and finds from this combination that Professor Hansen's coefficient of secular acceleration must be increased by a quantity differing little from $0''{\cdot}755$. The argument of latitude must also be increased by $45''$ nearly multiplied into the number of centuries anterior to 1800. The four eclipses are thus brought into perfect harmony. Professor Hansen's coefficient of tropical secular acceleration is $13''{\cdot}301$, including $1''{\cdot}121$ due to the secular acceleration of precession of the equinoxes. By the increase above mentioned, the coefficient of tropical secular acceleration is raised to $14''{\cdot}056$, and that of sidereal secular acceleration to $12''{\cdot}935$.

Observations in the Saturnian System. By Capt. W. S. Jacob.

"I beg to submit to the notice of the Society a portion of the results of my observations on the Saturnian System. Those of *Titan* have been reduced, numbering 67 sets of measures of angle, and 54 of distance. Of these latter 20 were taken within 15° (in longitude) of elongation, and will be proper for determining the value of the semi-major axis; but 3 of them were taken with the old micrometer furnished by Lerebours along with the instrument: a better one by Dollond being now generally em-

ployed, which is somewhat rickety, and should in my opinion be rejected; but it happens to be of little consequence to the result whether they are included or not. The following corrected elements have been deduced, those marked (A) from the angles alone, and those marked (A + D) from the angles and distances combined. The latter are, of course, the best; but the difference is very trifling. In the epochs the light equation is included; *i.e.* in employing them the light equation must be first deducted from the time of observation.

For 1857·00, Mean Time at Greenwich.

	A.	A+D.
	° ′	° ′
ε =	299 45·1	299 46·2
i =	27 36·7	27 36·0
Ω =	167 58·6	168 0·0
e =	·027996	·027953
ϖ =	257°22′·4	256°51′·2

The orbit seems inclined to the plane of the ring by 36′, supposing Bessel's elements of the latter to be correct.

The following values of a^* have been deduced,—

No. (1) from the whole 54 measures;

No. (2) from the 20 elongations; and—

No. (3) from 17 elongations, rejecting the 3 suspected measures above alluded to.

(1)	176″·895
(2)	176″·927 ± ·07
(3)	176″·886 ± ·07

It is manifestly of little importance which of these be adopted as the true value; and we may safely take 176″·90 as being within less than 0″·1 of the truth. The mean motion may be considered as very exactly known, since my epoch differs by only 7′ from Bessel's. The error cannot, therefore, well exceed 0′·5 per annum, or $\frac{1}{1{,}000{,}000}$ of the whole; taking then the daily motion 22°·577008, the value of *Saturn's* mass will be = ·00028765 or $\frac{1}{3476{\cdot}4}$ if we adopt Bouvard's value of the mean distance, viz. 9·543301; or if we prefer Bessel's (9·542189), the value will be =·00028759 or $\frac{1}{3477{\cdot}1}$

These values are uncorrected for perturbations; but the effect of these must be very small; the ring and protuberant equator will tend to increase the apparent mass, while the solar attraction will diminish it. I shall be able to form a better judgment as to whether the *balance* of effect is sensible or not, when the observations of the remaining satellites have been reduced.

* Semi-major axis reduced to *Saturn's* mean distance.

The details of these observations will be printed hereafter; but I thought an abstract of the results might be interesting in the meantime.

I should mention that the value of the micrometer scale has been very well determined; last year I made another attempt to ascertain the temperature-coefficient, but failed for want of a sufficient range of temperature; the resulting values of one revolution were—

	Temp.
″	°
23·2682 ± ·0029	70·7
23·2649 ± ·0049	89·9
Mean 23·2665 ± ·0029	80·3

The temperature-correction should have had the opposite sign to that indicated by these observations; but the difference is accounted for by the amount of the probable error. The mean value must be pretty correct, and the temperature-correction is of no consequence here, as the temperature at the time of observation never differs more than a few degrees from 80. Any uncertainty of this kind could not well produce an error in *Titan's* elongation exceeding 0″·04, and may therefore be considered insensible.

Observatory, Madras.

New Double Stars discovered by Mr. Alvan Clark, Boston, U.S.; with appended Remarks, by the Rev. W. R. Dawes.

No.	Designation.	R.A	N.P.D.	Mag.	Approx. Dist.	Tel. of Discovery.	Date of Discovery.
		h m	° ′		″	Inch.	
1	* Andromedæ	0 13 5	57 49	7, 7	0·4	7⅛	Oct. 1856
2	95 Ceti	3 10·7	91 29	5½, 10	0·8	7½	20 Dec. 1853
3	Weisse's Bessel, vi. 109	6 4·3	94 38	6½, 9	1·1	7½	6 Feb. 1854
4	Weisse's Bessel, vi. 1291	6 42·2	104 59	6, 9	1·0	4¾	17 Feb. 1852
5	8 Sextantis	9 45·1	97 24	6, 6½	0·6	4¾	7 April, 1852
6	* Corvi	12 0·3	109 32	6		4¾	19 May, 1852
7	μ Herculis, B. & C.	17 40·6	62 11	10½, 11	1·8	7¾	July, 1856
8	* Herculis	17 47·4	60 17	8¾	0·3	7¾	July, 1856
9	* Herculis	17 48·7	60 9	10, 10½	1·1	7¾	July, 1856
10	21 Sagittarii	18 16·4	110 37	5, 8	2·5		
11	Weisse's Bessel, xviii. 391	18 17·2	91 39	7, 7¼	0·5	7¼	30 July, 1854
12	Weisse's Bessel, xix. 1273	19 50·6	92 38	7¼, 8	0·9	7¼	18 July, 1854

" The places of these difficult objects have been from time to time communicated to me in letters from their discoverer, who has adopted the plan of testing the efficiency of his object-glasses when completed by sweeping for *new* double stars of the last degree of difficulty, rather than by the examination of objects whose character was previously known. At first, under the impression that every such object in the northern hemisphere visible with telescopes of moderate aperture must already have been picked up and registered during the careful examinations of that portion of the heavens by the Struves with the Dorpat refractor of 9·6 inches' aperture, and with the Poulkova 6f 15, Mr. Clark confined his search to the southern hemisphere; and his diligence and skill were rewarded by the discovery of several interesting objects, which, it might be supposed, would hardly have escaped the Dorpat telescope if they had been as decidedly double in 1826 as they are now. Latterly, however, having ventured to extend his researches northward, he has made some discoveries which are almost startling (especially the duplicity of the very minute companion of μ *Herculis*), and are sufficient to show that there is much which may be achieved by a diligent use of instruments of moderate dimensions, provided they are also of extreme perfection. A few notes on some of the most interesting of these objects may not, perhaps, be unacceptable.

" 1. This star has a good altitude at Poulkova, and its magnitude entitles it to a place in Otto Struve's catalogue. Its omission there may reasonably lead to a suspicion that it has a binary character, and has of late years come out from a state of apparent singularity. I have obtained an approximate measure of this star, but have not examined it under sufficiently favourable circumstances.

" 2. Of 95 *Ceti* I have repeatedly obtained measures; but it is a delicate object; and from its moderate altitude here requires fine circumstances. The small companion, which has a purplish tint, is faint and close, and may, therefore, have easily escaped detection at Dorpat.

" 5. Notwithstanding the moderate meridional altitude of 8 *Sextantis* at Dorpat (about 24°), it may reasonably be doubted whether its duplicity would have been left to be discovered with a $4\frac{3}{4}$-inch object-glass, however perfect, if no change had occurred in its appearance since Struve's scrutiny of that part of the heavens.

" 7. The position and distance of the small star with respect to μ *Herculis* were observed by Struve at Dorpat on one night in 1829, on two nights in 1832, and on three in 1836; and also on one night at Poulkova with the 15-inch refractor in 1851. Yet no suspicion was recorded on any occasion of the companion being double. It is, therefore, truly astonishing that Mr. Alvan Clark should have detected its unsuspected duplicity with an object-glass whose aperture is only $7\frac{3}{4}$ inches! I have succeeded in measuring it pretty well in position, but only approximately in dis-

tance; the faintness of the components almost forbidding the slightest illumination, though they bear a high power on Clark's 8-inch object-glass, — about 700 suiting them best. My results are P = 58°·97; D = 1″·85 ±. It has been shown by Struve (*Pos. Mediæ*, p. ccxvii.) that μ and its companion have a common proper motion; so that in this respect they are similar to μ and μ^2 *Boötis;* and as the companion of μ *Herculis* has now been discovered to be *double*, it only remains that it should prove to be *binary* to render the resemblance complete. It is, therefore, earnestly commended to the attention of those observers who possess telescopes competent to deal with it. As the small star *precedes* the large one, the former is properly μ^1, and the latter, μ^2, if that nomenclature be adopted.

" 8. This star is about as difficult as the closest of the Poulkova catalogue; and though on a fine night elongated with the 8-inch object-glass I now have in use, would require the full power of a 15-inch refractor fairly to divide it. That it attracted Mr. Clark's attention as a double star is sufficient to prove that his eye as well as his telescope must possess extraordinary power of definition.

" 9. This double star forms a good introduction to the small one of μ *Herculis;* its components being brighter by about half a magnitude of my scale. With my 8-inch object-glass and power 697, I have obtained, P = 229°·48; D = 1″·119.

" 11. A very difficult object, though decidedly elongated with a 7½-inch aperture. My measures in 1854 gave, P = 178°·10; D = 0″·425, the latter a mean of two estimations.

" 12. A neat and not very difficult object; it ought certainly to have been seen at Dorpat if it were as separate then as it is now. My measures with Clark's 7½-inch object-glass gave in 1854, P = 333°·76; D = 0″·863."

" *Haddenham, Thame, July* 9, 1857."

Results of the Observations of Small Planets made at the Royal Observatory, Greenwich, in the Month of June, 1857.

(*Communicated by the Astronomer Royal.*)

Phocea.

Mean Solar Time of Observation.	Apparent R.A.	Apparent N.P.D.
h m s	h m s	° ′ ″
1857, June 17 13 24 55·3	19 9 52·16	72 58 0·61
22 13 2 23·1	19 6 59·07	71 40 35·90
24 12 53 13·6	19 5 41·15	71 13 0·26
26 12 44 0·2	19 4 19·37	70 47 32·54
27 12 39 21·9	19 3 36·93	70 35 33·41

Lætitia.

Mean Solar Time of Observation.	Apparent R.A.	Apparent N.P.D.
h m s	h m s	° ′ ″
1857, June 1 11 31 34·8	16 13 8·12	95 7 8·68
2 11 26 49·2	16 12 18·31	95 5 32·04
8 10 58 23·6	16 7 27·37	94 59 7·99
12 10 39 37·9	16 4 24·88	94 57 50·19
13 10 34 58·0	16 3 40·72	94 57 54·50
15 10 25 41·4	16 2 15·76	94 58 25·64
17 10 16 27·9	16 0 53·80	94 59 36·76
22 9 53 42·6	15 57 47·54	95 5 9·12
23 9 49 12·6	15 57 13·39	95 6 41·51
24 9 44 43·9	15 56 40·52	95 8 21·48

On the Application of the Formulæ for Precession in the case of Stars near to the Pole; with a Correction of a trifling Error in the Table given by Mr. Baily in the Preface of the B.A. Catalogue. By R. C. Carrington, Esq.

In the exposition of the formulæ of Bohnenberger, given by Bessel in the *Tabulæ Regiomontanæ*, and elsewhere; although it has manifestly been the aim to attain the utmost brevity, it does not appear to have been noticed that the expressions for the auxiliary angles

$$(z+\lambda),\quad (z'-\lambda'),\quad \text{and } \theta,$$

may be given in formulæ involving only the times and constants, in all cases in which the tangent of the angle $\frac{1}{2}(\psi'-\psi)$ does not sensibly differ from its circular measure, cases which include all those commonly occuring. Thus, for Bessel's constants, if the star have to be brought from y to y', and $t=y-1750{\cdot}0$, and $t'=y'-1750{\cdot}0$,—

$$z+\lambda = +23''{\cdot}0144\,(t'-t) - 0''{\cdot}0115\,(t'+t) - 0''{\cdot}000056\,.\,t'^2 - 0''{\cdot}000210\,.\,t^2$$
$$z'-\lambda' = +23''{\cdot}0144\,(t'-t) + 0''{\cdot}0115\,(t'+t) + 0''{\cdot}000210\,.\,t'^2 + 0''{\cdot}000056\,.\,t^2$$
$$\theta = +20''{\cdot}0652\,(t'-t) \quad \ldots\ldots \quad - 0''{\cdot}000048\,.\,t'^2 + 0''{\cdot}000048\,.\,t^2$$

Expressed thus, we perceive at once that Mr. Baily has fallen into error in assuming, in page 40 of the Preface of the B.A.C., that for 1850·0 the values of $z+\lambda$ and $z'-\lambda'$ are each evanescent, as well as in stating that their variations are uniform. In fact, the differences are nearly constant, and for 1850·0 the terms $(z+\lambda)+(z'-\lambda')$ cancel one another. The oversight introduces a discontinuity in the values tabulated, which perplexed me, in

following so careful a person as Mr. Baily, till I perceived the nature of his mistake. Although the error arising from his assumption would in most cases be exceedingly small, it may be worth while to give the table in a correct form.

Precession-Constants (*Bessel's Elements*).

From 1850·0 to	$(z+\lambda)$	$(z'-\lambda')$	θ
	′ ″	′ ″	′ ″
1800	−19 14·69	−19 7·91	−16 42·90
1810	−15 24·72	−15 17·42	−13 22·30
1820	−11 34·76	−11 26·89	−10 1·71
1830	− 7 44·82	− 7 36·31	− 6 41·13
1840	− 3 54·88	− 3 45·70	− 3 20·56
1850	− 0 4·96	+ 0 4·96	0·00
1860	+ 3 44·95	+ 3 55·66	+ 3 20·55
1870	+ 7 34·85	+ 7 46·40	+ 6 41·09
1880	+11 24·74	+11 37·19	+10 1·62
1890	+15 14·62	+15 28·02	+13 22·15
1900	+19 4·49	+19 18·88	+16 42·66

It is plain that Mr. Baily computed the values for 1800 and 1900 correctly, and then went wrong as I have pointed out.

Some may now prefer using the constants, which result from the elements adopted by Peters, and given on page 71 of his *Num. Const. Nutations.* We then have (counting t and t' from 1800·0)

$$z+\lambda = +23''\cdot0311\,(t'-t) - 0''\cdot0000497\,.\,t'^2 - 0''\cdot0001922\,.\,t^2$$
$$z'-\lambda' = +23''\cdot0311\,(t'-t) + 0''\cdot0001922\,.\,t'^2 + 0''\cdot0000497\,.\,t^2$$
$$\theta = +23''\cdot0611\,(t'-t) - 0''\cdot0000432\,.\,t'^2 + 0''\cdot0000432\,.\,t^2$$

which furnish us with the following—

Precession-Constants by Peters' Elements.

From 1850 to	$(z+\lambda)$	$(z'-\lambda')$	θ
	′ ″	′ ″	′ ″
1800	−19 12·03	−19 11·43	−16 42·94
1810	−15 21·73	−15 21·10	−13 22·35
1820	−11 31·43	−11 30·73	−10 1·76
1830	− 7 41·15	− 7 40·32	− 6 41·16
1840	− 3 50·87	− 3 49·88	− 3 20·57
1850	− 0 0·61	+ 0 0·61	0·00
1860	+ 3 49·65	+ 3 51·13	+ 3 20·56
1870	+ 7 39·89	+ 7 41·69	+ 6 41·11
1880	+11 30·13	+11 32·29	+10 1·66
1890	+15 20·35	+15 22·93	+13 22·20
1900	+19 10·57	+19 13·60	+16 42·73

It is to be regretted, in my humble opinion, that the use of these direct and exact formulæ is not commonly preferred to the use of secular variations derived by their expansion in series. It

appears that this arises in great measure from an apparent obstacle presented by the troublesome computation of the value of

$$\tan (A' - A) = \frac{\sin A \,.\, \sin \theta \,(\text{cotan}\, \delta + \tan \tfrac{1}{2}\theta \,.\, \cos A)}{1 - \cos A \,.\, \sin \theta \,(\text{cotan}\, \delta + \tan \tfrac{1}{2}\theta \,.\, \cos A)};$$

which undoubtedly looks repulsive enough for daily use. But as Mr. Baily has observed, the second term within the brackets may in almost all cases be neglected; and, as I beg to add, the computations greatly facilitated by the arrangement of the term thus,—

$$p = \sin \theta \,.\, \text{cotan}\, \delta \,.$$

$$\tan (A' - A) = p \,.\, \cos A \,.\, \frac{1}{1 - p \,.\, \cos A} \,.\, \tan A;$$

the factor, $\log \frac{1}{1 - p \,.\, \cos A}$ being extracted at sight from a small table of 5-figure logarithms of the quantities,—

$$\text{Log}\, n, \quad \text{Log}\, \frac{1}{1+n}, \quad \text{Log}\, \frac{1}{1-n},$$

with the argument $\log p \,.\, \cos A$.

Such a table, similar but different to the Gaussian logarithms, will be found of use in an observatory in many other instances.

Results of the Measures of γ Virginis for the Epoch 1857, *as Determined by Rear-Admiral Smyth, at the Hartwell Observatory, with a Double-wire Micrometer, under a power of* 340.

Date (t)	Position. $\angle$	Weight. w	$w(\angle - 170°)$	$w(t.-1857)$	Observations.	Distance. Δ	w	$w.\,\Delta.$	Observations.
	° ′		′			″		″	
1857·38	171 29	62	+ 5518	2356	10	3·3378	31	103·472	7
— ·38	171 13	46	+ 3358	1748	8	3·5661	12	42·793	4
— ·40	170 20	24	+ 480	960	4	3·5443	24	85·063	6
— ·41	170 23	20	+ 460	820	4	3·5680	17	60·656	5
— ·42	169 59	44	— 44	1848	6	...	...	...	...
— ·43	170 31	30	+ 930	1290	6	3·4927	23	80·332	6
— ·45	170 39	25	+ 975	1125	5	3·4827	28	97·516	6
— ·47	170 11	18	+ 198	846	4	3·5382	12	42·458	4
— ·47	169 28	34	— 1088	1598	6	3·4531	24	82·874	6
		303	+ 10787	12591	53		171	595·164	44

Conclusion.

Sum of ($\angle$ *s. w.*), ∴ mean of Position = 170°35′·6.

Sum of ($\angle$. *w.*), ∴ mean of Distance = 3″·4804.

Sum of (w . *t.*), ∴ mean of Epoch = 1857·415.

At the request of Admiral Smyth the following epochs were communicated to him by the observers whose names are respectively attached:—

	Position.	Distance.	Epoch.
	°	″	
Airy	173·0	3·64	1856·96
Wrottesley	171·36	3·665	1856·97
Dawes (*double image*)	170·08	3·586	1857·35
Dawes (*wire mic.*)	169·93	3·561	1857·42
Fletcher	171·55	3·537	1857·41

Observations of Comet III. 1857. By Dr. Donati.

(*Communicated by Mr. Drach.*)

	Florence M.T.	Comet—Star. R.A.	Comet—Star. Decl.	No. of Comparisons.	Comet's App. R.A.	Comet's App. Decl.
	h m s	m s	′ ″		h m s	° ′ ″
June 28	14 34 36	+1 20·78	− 5 51·1	2 with (*a*)	4 16 30·36	+45 42 46·1
	14 55 27	+5 26·59	−26 7·0	2 with (*b*)	4 16 39·95	+45 43 7·4

Mean Position of Comparison Stars for 1857.

	R.A.	Decl.	
	h m s	° ′ ″	
(*a*)	4 15 9·58	+45 48 33·3	Lalande 8163–64
(*b*)	4 11 13·15	+46 9 10·0	B.A.C. 1323

Elements of Comet III. 1857. By M. Pape.

T	= July 18·01175, M.T. Berlin, 1857.	
	° ′ ″	
ϖ	= 249 37 39·8	Mean Equinox 1857·0
Ω	= 23 40 58·6	
i	= 58 59 32·2	
Log q	= 9·565259	

Motion retrograde.

These elements were calculated from the Berlin Observations of June 23 and July 3, and the Altona Observation of July 14.

Discovery of New Planets.

New Planet discovered by M. Goldschmidt.

On the 28th of June, M. Goldschmidt discovered a new planet at Paris. This forms the forty-fifth of the group of minor planets. The following elements have been calculated by Dr. Forster:—

Epoch	.....	1857, July 8·5000
		° ′ ″
M	.....	44 19 29·6
π	.....	208 16 39·4
Ω	.....	148 19 38·2
i	.....	6 34 52·6
φ	.....	5 14 44·0
log a	.....	0·430856
μ	.....	801″·1664

These elements were calculated from the following positions:—

	M.T. Berlin.	R.A.	N.P.D.
	h m s	° ′ ″	° ′ ″
July 2	11 36 24	245 27 26·2	−11 52 29·1
8	12 0 22	244 54 52·5	−12 9 15·9
14	11 43 9	244 36 34·1	−12 29 16·2

New Planet discovered by Mr. Pogson.

On the 16th of August, the forty-sixth of the minor planets was discovered by Mr. Pogson at the Radcliffe Observatory. The following position is given for the evening of discovery:—

	M.T. Oxford.	App. R.A.	App. Dec.
1857, Aug. 16	$9^h\ 49^m\ 10^s$	$20^h\ 20^m\ 27^s·16$	−16° 20′ 53″·7

From this observation and from the Berlin observations of August 28 and September 8, M. Pape has calculated the following elements:—

Epoch, August 16·5, 1857, M.T. Berlin.

		° ′ ″
M	.....	334 46 12·5
π	.....	344 56 16·9
Ω	.....	181 30 45·9
i	.....	2 17 46·8
φ	.....	7 2 34·0
log a	.....	0·390385
log μ	.....	2·964430

New Planet discovered by M. Luther.

Another planet, numbering the forty-seventh of the group between *Mars* and *Jupiter*, was discovered by M. Luther at the Observatory of Bilk on the 15th of September. The following position was taken on the same evening:—

M.T. Bilk.

1857, Sept. 15 $12^h\ 29^m\ 16^s·4$ α (47) 0° 49′ 40″·0 δ (47) −0° 42′ 35″·0

Daily motion −12″·7 −3′·2

The star of comparison (8·9) was thus taken according to Bessel's zone 112 and 136:—

Apparent Place for Sept. 15.		Mean Place 1857·0.	
0° 32′ 14″·9	−0° 42′ 58″·8	0° 31′ 22″·7	−0° 43′ 21″·6

Two New Comets.

On the evening of the 28–9th of July a new comet (Comet IV. 1857) was discovered by M. Dien, at the Imperial Observatory, Paris. The same comet was also discovered independently, by Professor Habicht, at Gotha, on the evening of the 30th of July. The latter remarks that at the time of its discovery the diameter of the comet was about 3′, but it appeared of a loose, uniform structure, and very faint. Observations of this comet by Dr. Trettenero will be found at page 268.

Elements of Comet IV., 1857. By Dr. Bruhns.

T	=	August 23·63288	
π	=	21 16 29·2	Mean Equinox 1857·0
Ω	=	201 29 33·6	
i	=	32 33 58·7	
Log q	=	9·874808	

Motion direct.

This comet was also discovered independently by Dr. Peters at the Dudley Observatory in Albany, U.S., as appears from the following letter addressed by Dr. Gould, the Director of the Observatory to the Editor:

(*Letter from Dr. Gould to the Editor.*)

"I have the honour to announce to you the discovery of a comet at the Dudley Observatory in Albany, by Dr. C. H. F. Peters, who has obtained the following position with the ring-micrometer of the comet-seeker, none of the large instruments having yet been mounted:—

	Albany S.T.	Comet's R.A.	Comet's Decl.	No. Comps.
	h m s	h m s	° ′ ″	
1857, July 25	20 5 51·0	3 33 32·9	+59 9 14	10
26	21 7 20·8	3 46 26·1	+58 18 33	

"The comparison star was Oeltz Argel 3999, 4000 at the first, and Oeltz Argel 4278 at the second observation; the differences being uncorrected for refraction.

"The comet is exceedingly faint, and without visible nucleus.

"*Cambridge*, 1857, *July* 27."

On the 20th of August a new comet (Comet V., 1857) was discovered by M. Klinkerfues at Göttingen. The following elements were calculated by Dr. Bruhns:—

T	=	1857, September 30·85270 Berlin M.T.
π	=	250 21 18·5
Ω	=	14 46 30·3
i	=	56 18 16·0
Log q	=	9·752190

Motion retrograde.

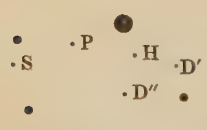
These elements have a distant resemblance to the elements of Comet III., 1790, and Comet I., 1825.

Note on the Star recently Discovered in the Trapezium of the Nebula of Orion. By M. Abbadie.

(*Letter to Mr. Carrington.*)

"When writing on the 21st ult. to Admiral Manners, to thank him for getting the *Monthly Notices* sent to me, I informed him of the discovery of a ninth star in the trapezium of the nebula of *Orion*, made by M. Porro in Paris with his 52-centimètre refractor. I then called it the eighth star, having overlooked the star H discovered by Herschel (Sir John, I believe). I then invited other astronomers to search for and confirm the new discovery. Father Secchi has now made the following communication, which I translate from the extract of his journal, dated February 10, 1857:—

"'Air excellent; the sixth star (H) of the trapezium is not visible, although the atmosphere is beautiful. Why? In place of it, I think I see a small star in the centre of the trapezium.' The Roman astronomer then says that, like M. Porro, he found great difficulty in seeing the stars D″ and D′. He takes the latter for the companion of H, which Sir J. South had already mentioned as a double star.



"I believe that there is in England no refractor with an aperture of 52 centimetrès, or 19·2 old Parisian inches; but Father Secchi's observation shows that good and relatively small refractors may, on chosen nights, show this very faint test-object. The position and distance of the star P have not yet been referred by measurement to one of its neighbours.

"*Königsberg, Prussia, 1857, June 17.*"

On the Variability of 30 *Herculis.* By Josh. Baxendell, Esq.

In October and November 1855, 30 *Herculis* was almost invisible to the naked eye, even on the finest nights; and the mean

of several comparisons with other stars, made at different times, gave its magnitude $=5{\cdot}9$. It is now, however, a conspicuous star, and not less than $4{\cdot}9$ magnitude,—the mean of several nights' estimations since June 18 being $4{\cdot}85$. Professor Argelander rated this star $5{\cdot}6$ magnitude, or less than υ, 52 and 42 *Herculis;* but it is now brighter than any of these stars. On the other hand, it appears from the *Radcliffe Observations* of 1851 that it was of the $4{\cdot}8-5{\cdot}0$ magnitude at the end of June and beginning of July of that year. It is very probable, therefore, that its light is subject to periodical changes; but the observations hitherto made are not sufficient to afford even a rough approximation to the length of the period. The red colour which is so common amongst the variable stars (especially those of long period) is also very decided in this star.

Manchester, July 7, 1857.

Discovery of two New Planets. By M. Goldschmidt.

(*Extract of a Letter to Mr. Hind.*)

"I have the pleasure to announce to you the discovery of two new planets (the forty-eighth and forty-ninth) which I made on the same evening, viz. the 19th of this month. Whilst I was engaged in observing the 48th, I neglected the investigations relative to a star which had vanished in the vicinity of $\varkappa$ *Aquarii*, but late in the evening my attention was directed to a star which turned out to be the planet. On the 20th and 21st I found that it had shifted its position, whereupon I took its place micrometrically, and have the honour to communicate to you the results.

(48) Planet, Sept. 19, 10^h, Graph. Posit. R.A. $22^h\,27^m\,11^s$, $-5^\circ\,52'$

			R.A.	
		h m	h m s	° ′
(48)	Sept. 20	12 7	22 26 31	−5 57·5 (the Decl. at $11^m\,28^s$)
(48)	Sept. 22	11 5	22 24 25·4	−6 7·8
(49)	Sept. 21	9 37	22 28 28·8	−5 4
(49)	Sept. 22	8 24	22 27 55	−5 8·5

"I wanted time to calculate and add the precession of the star of comparison from 1857·0 to the epoch of the constants. The 48th resembles a star of the 11th magnitude: the 49th I found to change in brightness from 10 to 11.12 magnitude. I shall be glad if you will be so kind as to communicate this intelligence to the Royal Astronomical Society."

Observations of Comet IV. 1857, *made at the Royal Observatory, Padua, by Dr. Virgilio Trettenero.*

(*Extract of a Letter from Professor Santini, of Padua, to the Astronomer Royal, dated* 1857, *August* 30.)

Month and Day.	Padua M.S.T.	App. R.A. of Comet.	App. Decl. of Comet.	No. of Comparisons.	Star of Comparison.
	h m s	h m s	° ′ ″		
Aug. 18	14 30 51·8	6 37 24·49	+29 6 6·8	6	B.A.C. 2197
22	14 28 40·8	6 55 6·95	23 58 22·0	3	B.A.C. 2350
25	14 39 52·9	7 7 23·86	20 21 7·0	5	B.A.C. 2423
27	14 44 31·6	7 15 11·24	+18 4 9·6	4	Bess. Z. 281

The apparent position of Bessel's star is as follows:—

R.A. = $7^h\ 18^m\ 46^s{\cdot}04$ Decl. = $+18^\circ\ 10'\ 22''{\cdot}1$

In the reductions corrections have been applied for the difference of refraction.

On a Method of finding the Distance of a Planet from the Earth. By Professor De Gasparis.

(*Extract of a Letter to Mr. Hind.*)

"I beg of you to insert in the *Monthly Notices* the following note:—

"'The reader is acquainted with the curve proposed by Mr. Waterston, the equation of which is $x=(y^2+1)^{-\frac{3}{2}}$. This curve being described by a graphic process once for all, gives approximately the distance of a planet from the earth by means of a straight line, the position of which is determined in each particular case. Mr. Challis determines the coefficients of this straight line by supposing that in the development of the heliocentric co-ordinates as a function of the time, we stop at the terms of the second degree (*Mem. Ast. Soc.* vol. xvii.). I have, however, succeeded in taking into account the terms multiplied by the cubes. One of the terms determined by Mr. Challis has for its coefficient $\frac{\theta\theta'}{2}$, and this factor in my investigation is replaced by $\frac{\theta'^2}{6}-\frac{\theta^3 c+\theta'^3 d}{6(\theta c+\theta'' d)}$. The symbols c, d, are the same as those in the *Theoria Motus*, p. 147. By the aid of this expression I have calculated small tables to be substituted for the graphic curve. The unknown quantity given by these tables is connected by a very simple relation with each of the unknown quantities of the problem, that is to say, with the radius vector, the curtate distance, and the arc whose value is given by an equation of the fourth degree in the method of Gauss. To give an idea of the practical utility of these tables, I may state that, upon applying them to a

numerical example, I obtained for the curtate distance the value 1·20181; employing the factor $\frac{\theta\theta''}{2}$, I obtained 1·24994. Now the exact value is 1·20151. I have given the details of this case in the preface to the tables which I have sent to the *Astronomische Nachrichten*.'"

Simple Method of Finding the Focal Length of small Convex Lenses. By the Rev. T. W. Webb.

The determination of the focal length of a small convex lens is a matter of considerable difficulty, at least in the hands of an amateur. Not only is the process of direct measurement a delicate and somewhat troublesome one, but the result is not satisfactory, as it is complicated with uncertainties arising from the amount of spherical aberration, which with a large angle of aperture may have a considerable effect; from the thickness of the lens; and from the difference of the measure from the centre and from the margin of the posterior surface.

These difficulties, it is true, are avoided, as to the usual object of such measurements, by the employment of the dynameter, or any equivalent contrivance by which the focal image is measured instead of the focal length; but, as these optical means are not always at hand, it may perhaps be of some use to explain a mode of measurement practised by myself very successfully more than twenty years ago. The requisite apparatus, if it can be so termed, will be described in its original simplicity; a little ingenuity would easily improve it; but even in its first rude trial it was found adequate to its object.

Three pieces of cork are perforated by a knitting-needle, so as to slide along it. To the centre one is attached, in a vertical position, and with its axis parallel to the knitting-needle, the lens to be measured; in each of the others is inserted a piece of a sewing-needle, with the point uppermost, and having its length so regulated that a line joining these points would pass, as nearly as may be, through the centre of the lens. The cork discs carrying these needles are then moved backwards and forwards, till the inverted image of the one needle's point, formed by rays passing through the lens, is seen coincident and equally distinct with the other needle's point, when both are viewed at once through a tolerably strong magnifier applied to the eye, and directed towards the lens. Then, if the needle-points are sensibly equidistant on each side of the lens, a condition which can be quite sufficiently attained in the course of a few trials, it is evident that they occupy the conjugate foci, and the distance between them being carefully measured with compasses will be, as a very simple proposition in optics will show, *four times the amount of the focal length of the lens for parallel rays.*

The apparent defect of this method is the uncertainty whether the points, when the image of one is formed close to the other, are equidistant from the lens, the setting of which, or its form unless equally convex on each side, may render actual measurement unsatisfactory. A brief and simple calculation, however, founded upon Cor. 3 to Prop. xlv. of Wood's *Optics*, will show that any uncertainty in the focal length for parallel rays arising from this source of error would be so small in proportion to the corresponding change in the relative position of the conjugate foci, that the needle-points would be obviously and unmistakeably out of their proper places, that is, at very sensibly unequal distances from the lens, before the resulting focal length would be materially affected.

On the other hand, the advantages of this method are easily to be recognised. All errors are eliminated which arise from spherical aberration, the thickness of the lens, or the difference between the length of the marginal and that of the central ray; and the quantity actually measured, being four times greater than the final result, introduces into the latter a microscopical precision; while the actual process of measurement requires nothing but a careful eye, a steady hand, and a little experience, to ensure a degree of accuracy quite sufficient for all practical purposes.

Hardwick Parsonage, Herefordshire,
June 11, 1857.

Astronomical and Meteorological Observations made at the Radcliffe Observatory, Oxford, in the Year 1855, *under the Superintendence of Manuel J. Johnson, M.A., Radcliffe Observer.* Vol. XVI., Oxford, 1856.

The first part of this volume consists as usual of the meridian observations, with the necessary elements for reduction. Then follows a catalogue of stars observed in the year 1855, showing the result of each individual observation. This is succeeded by a catalogue of final results, exhibiting the places of 1149 stars reduced to the beginning of the year 1860, and a catalogue of 164 stars within 6° of the North Pole. The latter contains the mean places of all the stars in the vicinity of the pole reduced to the beginning of 1855, which have been observed at the Radcliffe Observatory during the period comprised between 1840 and 1855, both years inclusive.

The second part of the volume is devoted to the observations with the heliometer and the investigation of the results deducible from them. The parallaxes of a few of the more interesting stars form the object of research. The stars selected are:— *Castor;* the star *b*, employed by Mr. Johnson in his investigation of the parallax of 1830 Groombridge, given in the fourteenth volume of the Radcliffe Observations; *Arcturus;* and, lastly, *α Lyræ.*

The following are the assumed mean distances between the primary stars and the stars of comparisons :—

Castor	from 2517 B.A.C.	... ...	137″·6214
b	from *a*	... ...	101·8972
b	from *c*	... ...	12·7722
Arcturus	from 4731 B.A.C.	... ...	43·2572
α Lyræ	from 6319 B.A.C.	... ...	39·5807
α Lyræ	from *	... ...	30·8356

The results for *Castor* seem to indicate a measurable parallax amounting to 0″·198.

The parallax of *b* is found by comparison with *a* to be 0″·037 with a probable error of 0″·119. Assuming, then, as may safely be done, that the stars *a* and *b* have equal parallaxes, Mr. Johnson remarks that the most probable value of the parallax of 1830 *Groombridge* will be obtained by combining together the contemporary measured distances of *a* and *b* from that star. In this way he obtains 0″·033 for the parallax of 1830 *Groombridge* with a probable error of 0″·028 ; a result almost identical with that at which Otto Struve had previously arrived.

By a comparison with *c* Mr. Johnson obtained for the parallax of *b* the value −0″·298 with a probable error of 0″·156. However he points out several circumstances tending to show that this apparently anomalous result is entitled to very small weight.

For the parallax of *Arcturus*, Mr. Johnson obtains the value 0″·1377 with a probable error of 0″·052.

The value found by Professor Peters is 0″·127 ±0·073. (*Etudes d'Astronomie Stellaire*, p. 99.)

The small probable error in this case, compared with that obtained for *Castor*, seems to Mr. Johnson to indicate that long distances are not favourable to exact measurement.

The parallax of *α Lyræ* by comparison with 6349 B.A.C. is found to be +0″·2703, with the probable error ·0444 ; by comparison with the un-catalogued star, the result obtained is −0·1127, with the probable error 0″·0697. Combining together the two series of measures in one investigation, Mr. Johnson obtains a parallax amounting to 0″·1412, with a probable error of 0″·0467. Otto Struve gives a parallax equal to 0″·1549 ±·0120, as the combined result of his father's, his own, and Professor Peters' determinations. (*Monthly Notices*, vol. xiii. p. 74.)

The remaining part of the work is devoted to the meteorological operations at the Observatory.

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Errata in Vol. XVII. of the Monthly Notices.

Page 2, line 3, *for* $4^h\ 22^m\ 26^s{\cdot}9$, *read* $4^h\ 42^m\ 26^s{\cdot}9$.
— 5, line 13, *for* ' of the bright edge,' *read* ' at the bright edge.'
— 10, line 10, *for* ' observation,' *read* ' obscuration.'
— 29, in Mr. Tennant's paper throughout, *for* ' frustrum,' *read* ' frustum.'
— 36, line 11, *for* ' weight of tube,' *read* ' weight of tube per square foot.'
— 145, in Professor's Powell's paper:—

	Lowndes	*for*	$\frac{1}{12{\cdot}1}$	*read*	$\frac{1}{17{\cdot}3}$
	Dawes	—	$\frac{1}{12{\cdot}5}$	—	$\frac{1}{15{\cdot}0}$
	Grove	—	$\frac{1}{13{\cdot}4}$	—	$\frac{1}{15{\cdot}1}$
	Lord Wrottesley	—	$\frac{1}{14{\cdot}1}$	—	$\frac{1}{16{\cdot}6}$
	Webb	—	$\frac{1}{15{\cdot}2}$	—	$\frac{1}{17{\cdot}8}$
— 147,	Chalmers	—	$\frac{1}{14{\cdot}4}$	—	$\frac{1}{15{\cdot}3}$

— — also *for* $3^{ft}\ 16^{in}$, *read* $3^{ft}\ 6^{in}$.
— 246, *dele* occultation of *α Virginis*, inserted at page 203.

For Errata in previous volumes, see pages 19, 49, 85, 162, 195. *Dele* the fifth in the list given at page 85, which had been already inserted in its proper place.

Erratum in the current Volume of Memoirs.

The reader is requested to correct the following clerical error in Mr. Main's paper on Refraction, published in the current volume of the *Memoirs* (vol. xxvi.):—

P. 62, line 11, *for* $30^{in}{\cdot}00$, *read* $29^{in}{\cdot}60$.

London:—Printed by G. Barclay, Castle St. Leicester Sq. and Published at the Apartments of the Society, October 28, 1857.

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